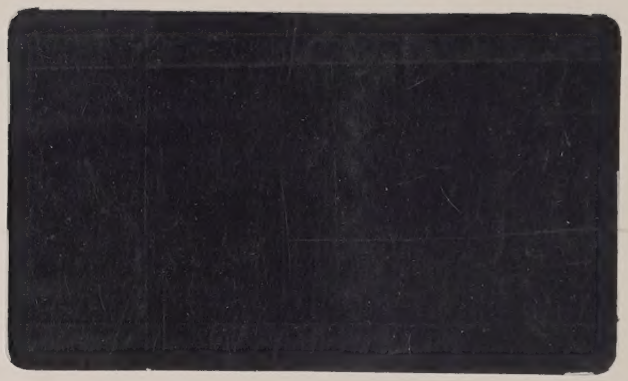
OPERATING AND INSTRUCTION MANUAL

MODEL RB-504 S-1269

RATIO BOX

NORTH ATLANTIC

industries, inc.



OPERATING AND INSTRUCTION MANUAL

MODEL RB-504 S-1269

RATIO BOX

NORTH ATLANTIC INDUSTRIES, INC.
HAUPPAUGE New York

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CAUTION

High voltage exists at several points in the instrument. Normal precautions consistent with good practice should be taken to reduce shock hazard.

A potential shock hazard exists when ungrounded power source or ungrounded case operation is employed. Persons operating the instrument should be made aware of and take precautions against this condition.

North Atlantic Industries, Inc. cannot be held responsible for damage to person or property in the process of or as a result of maintenance, calibration, or setting up of the instrument.

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SECTION I

GENERAL DESCRIPTION AND SPECIFICATIONS

General Description

The North Atlantic Model RB-504 Ratio Box is a precision inductive voltage divider. It utilizes the latest advances in transformer engineering and provides high ratio accuracy, readability, and reliability. Typical design features are high input impedance, low series output impedance, and excellent phase characteristics, which enable this instrument to be used in a wide range of test applications.

The North Atlantic Model RB-504 has been designed for either bench or rack-mounted service, and it occupies a minimum panel space while providing excellent readability on in-line window dials.

This model features 6 digit readout utilizing 5 switched decades with switching transient suppression and a single-turn potentiometer.

Applications of this instrument are included in the

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instrumentation bulletin contained herein. A more detailed treatise on applications is contained in the appended "Application Notes for 200 Series Phase Angle Voltmeters."

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Specifications

Ratio Range:	-0.111110 to +1.111110
Accuracy of Ratio for all Ratios from 10V Input to Maximum Rating:	±0.0001% Terminal Linearity
Frequency Range (within accuracy):	300 cps to 3kc. (±0.0002% T.L. 50 cps to 3kc)
Frequency Range (useful):	50 cps to 10kc
Nominal Input Impedance @ 400 cps:	200K
Maximum Input Voltage:	0.7f volts (f in cps) (not to exceed 350V)
Nominal Output Resistance (Maximum*):	8.5 ohms
Phase Shift:	Less than 1 minute.
Resolution:	5 decades plus 1 turn potentiometer.
Switches:	Heavy duty
Size, Weight:	3-1/2"H x 19"W x 8"D 22 lbs.

SECTION II

INSTALLATION

The North Atlantic Model RB-504 Ratio Box has been designed for either bench or rack-mounted service. Fold away legs and end plates are provided to facilitate use on the bench. The end plates are easily removed to allow quick conversion for rack mounting. The panel space required for the instrument is 3-1/2"H x 19"W.

SECTION III

THEORY OF OPERATION

The North Atlantic Model RB-504 Ratio Box consists of 5 decades of inductive dividers with tap selection provided by heavy duty, high reliability, rotary switches. Transient suppression is provided on the switches to allow maximum usability in nulling circuits. A one-turn wire-wound potentiometer is used in the 6th decade. The excitation for this potentiometer is provided by a winding having precisely 1/10th the voltage that excites the 5th decade. The potentiometer provides a 0-10ppm range for better than 1ppm resolution.

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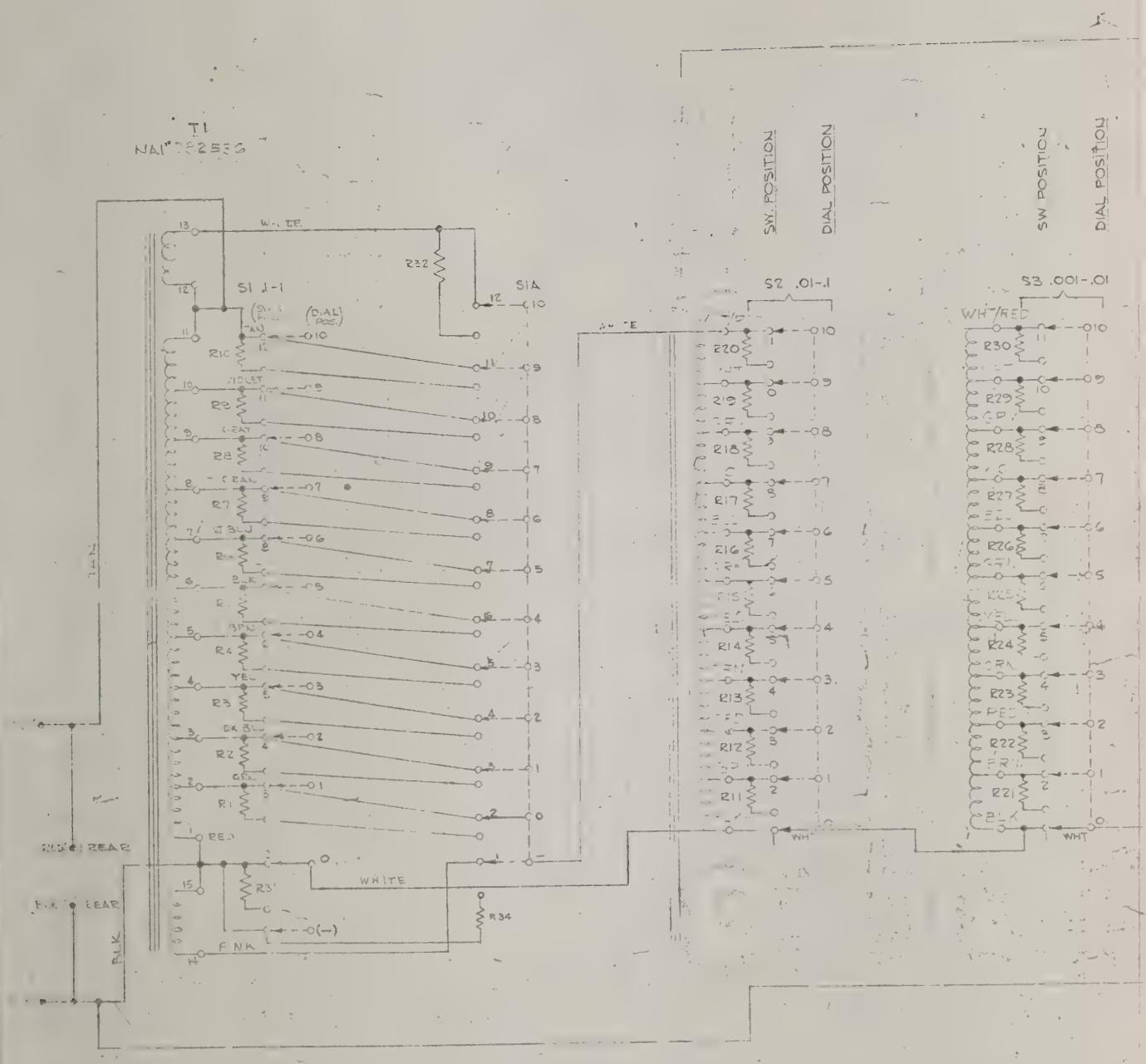
T1
S1 J-1
S1A
S2 .01-1
S3 .001-.01
SW. POSITION
DIAL POSITION
SW POSITION
DIAL POSITION
R232
R1C
R9
R8
R7
R6
R5
R4
R3
R2
R1
R3'
R34
R20
R19
R18
R17
R16
R15
R14
R13
R12
R11
R30
R29
R28
R27
R26
R25
R24
R23
R22
R21
WHITE
WHT/RED
VIOLET
GRAY
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BLK
BRN
YEL
DK BLU
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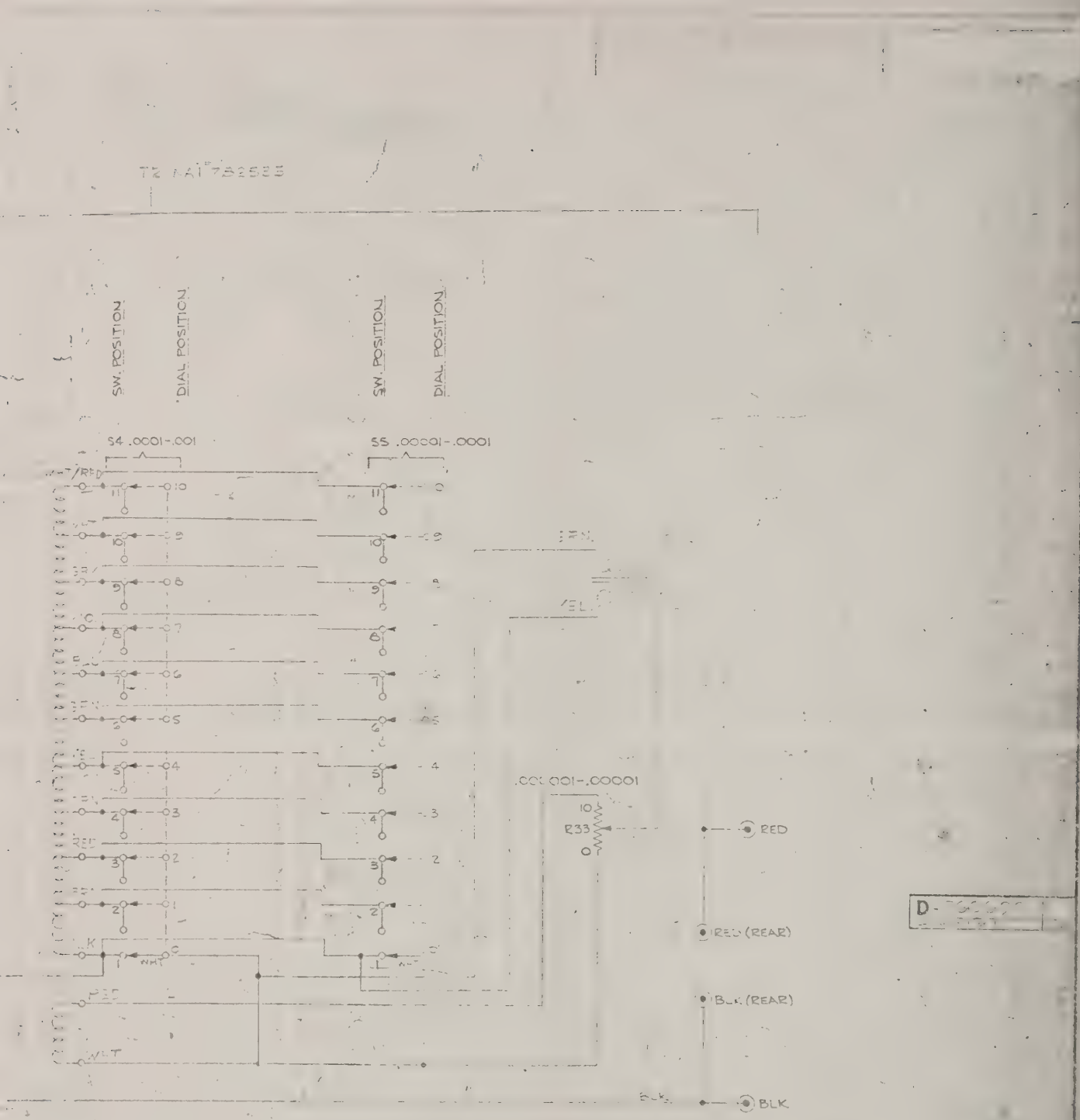
BLK
REAR
FRONT
WHITE
BLK


SW. POSITION
DIAL POSITION
SW. POSITION
DIAL POSITION
S4 .0001-.001
S5 .00001-.0001
.001-.00001
R33
RED
RED (REAR)
BLK (REAR)
BLK

SECTION IV

OPERATING PROCEDURE

Terminals

The input excitation to be applied to the RB-504 should be connected to the "IN" and "COM" terminals located on the front of the device. The high potential should be connected to the "IN" terminal and ground reference should be connected to the "COM" terminal. A terminal is also provided for case ground. The output of the Ratio Box is appropriately marked "OUT" and the low side "COM."

It is important that maximum input voltages do not exceed .7f x the frequency of operation in cps (not to exceed 350V regardless of frequency).

Switches

The ratio desired is set using the 5 rotary switches and the potentiometer. The first switch controls the most significant digits and covers the range of 0 to 1. The second, third, fourth, and fifth switches cover the ranges of 0 to .1, 0 to .01, 0 to .001, and 0 to .0001, respectively. The potentiometer controlling the sixth decade covers the range of 0 to .00001, providing readability of better than 1ppm.

SECTION V

MAINTENANCE

Calibration and Test Procedure

The precision inductive circuits contained within the RB-504 Ratio Box are extremely stable and capable of retaining the rated accuracy for an indefinite period of time. The accuracy of the RB-504 can be checked using the following procedure.

The circuit shown in Figure 5.1 uses a Phase Angle Voltmeter, such as North Atlantic's 200 Series, as a phase sensitive null detector; a Standard Ratio Box with an accuracy consistent with the National Bureau of Standards capability, and a bridging transformer to be used to compute the output ratios of the RB-504 and the Ratio Box Standard.

It is important that the bridging transformer used have a common-mode characteristic such that the error introduced by the transformer is no more than .2ppm of full scale excitation voltage.

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The RB-504 should be tested at an excitation voltage within its f rating and within the frequency range as outlined in the specifications. The RB-504 should be checked against the Ratio Box Standard for all decades. The null voltage read on the Phase Angle Voltmeter is directly related to the difference in the actual ratio output of the two devices. Relating this null voltage to the line excitation voltage will result in calibration data for the RB-504. $\left[\text{Error (ppm)} = \frac{\text{null error (uv)}}{\text{excitation voltage (volts)}}\right]$. This data will be accurate to within the validity of the test setup - i.e., the accuracy of the Standard Ratio Box and the common-mode error of the bridging transformer. If the magnitude and direction of error of the Standard Ratio Box and bridging transformer are known, a corrected set of data may be generated describing the actual error of the RB-504.

REPLACEMENT PARTS LIST

NAI PART NO	DESCRIPTION	QUANTITY
500063	Switch Assembly (S1)	1
500064	Switch Assembly (S2, S3)	2
500065	Switch Assembly, (S4, S5)	2
500023-1	Dial Assembly (for Rheostat R1)	1
500023-2	Dial Assembly (for S2, S3, S4, S5	4
500023-3	Dial Assembly (for S1)	1
200380	Window	1
782536	Transformer (T1)	1
782535	Transformer (T2)	1
201979	Knob	6
202048	Rheostat (15Ω)	1

Consistent with North Atlantic Industries' policy of continuously up-grading components and improving circuits, we reserve the right to substitute components which are functionally interchangeable for any of the parts shown above.

RB504-S1269

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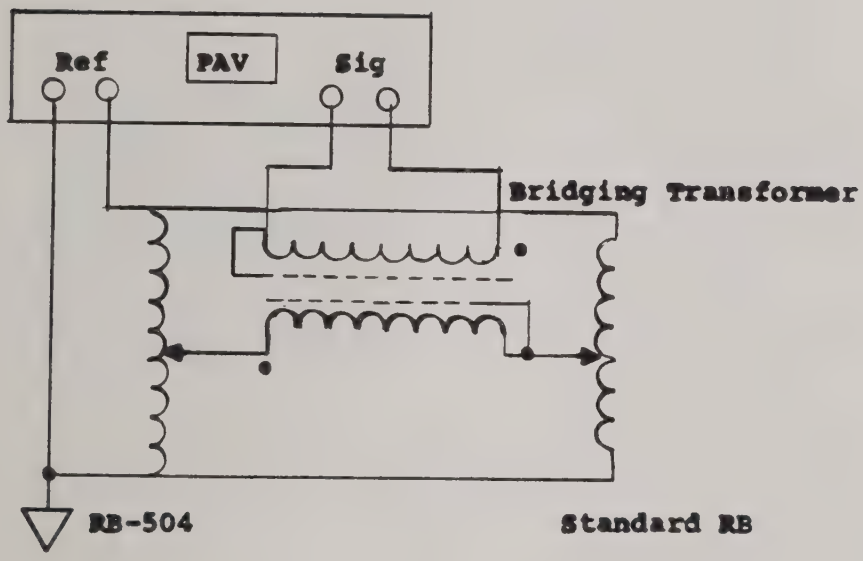

TEST SET-UP FOR RB-504

Figure 5.1

WARRANTY

A. The Seller warrants Products against defects in material and workmanship for one year from the date of original shipment. The Seller's liability is limited to the repair or replacement of Products which prove to be defective during the Warranty period. There is no charge under the Warranty except for transportation charges. The Purchaser shall be responsible for Products shipped until received by the Seller.

B. The Seller specifically excludes from the Warranty 1) calibration, 2) fuses, and 3) normal mechanical wear, eg, end-of-life on assemblies such as switches, relays, gear trains, etc. is dependent upon number of operations or hours of use, and end-of-life may occur within the Warranty period.

C. The Seller is not liable for consequential damages or for any injury or damage to persons or property resulting from the operation or application of Products.

D. The Warranty is voided if there is evidence that Products have been operated beyond their design range, improperly installed, improperly maintained or physically mistreated.

E. The Seller reserves the right to make changes and improvements to Products without any liability for incorporating such changes or improvements in any Products previously sold, or for any notification to the Purchaser prior to shipment. In the event the Purchaser should require subsequently manufactured lots to be identical to those covered by this Quotation, the Seller will, upon written request, provide a quotation upon a change control program.

F. No other Warranty expressed or implied is offered by the Seller other than the foregoing.

CLAIMS FOR DAMAGE IN SHIPMENT

The purchaser should inspect and fuctionally test the Product(s) in accordance with the instruction manual as soon as it is received. If the product is damaged in any way, including concealed damage, a claim should be filed immediately with the carrier, or, if insured separately, with the purchaser's insurance company.

SHIPPING

On products to be returned under warranty, await receipt of shipping instructions, then forward the instrument prepaid to the destination indicated. The original shipping containers with their appropriate blocking and isolating material is the preferred method of packaging. Any other suitably strong container may be used providing the product is wrapped in heavy paper or a plastic bag and surrounded with at least four inches of shock absorbing material to cushion firmly, preventing movement inside the container.

WARRANTY REGISTRATION

Please complete and mail this Warranty Registration Card without delay. Placing this Registration on file with our Service Department will assure that you receive applicable service data as issued. No postage is required. (Mailed on_____ by_____)

WARRANTY REGISTRATION

Date _____

Please register _____

Model No. _____ Serial No. _____

under the terms of the warranty stated in this Instruction Manual.

Name _____

Title _____ Dept. _____

Company _____

Address _____

City _____ State _____ ZIP _____

Calibration and maintenance responsibility has been assigned to the following person and/or department. Address applicable service data to (if same as above, please state):

Name _____

Title _____ Dept. _____

For our information please indicate:

Condition of instrument on receipt _____

Application _____

Will the instrument be: resold as part of a system? _____

maintained as company equipment? _____

SERVICE INFORMATION

This card is provided to aid you in obtaining prompt assistance with questions you may have regarding operation, calibration, maintenance or service parts for your North Atlantic instrument. State information desired and mail. No postage is required.

SERVICE INFORMATION REQUEST

Instrument _____

Model No. _____ Serial No. _____

We require the following service information: _____

_____

_____

_____

_____

Name _____ Title _____

Company _____ Dept. _____

Address _____

City _____ State _____ ZIP _____

Phone _____ Ext. _____

SERVICE INFORMATION

This card is provided to aid you in obtaining prompt assistance with questions you may have regarding operation, calibration, maintenance or service parts for your North Atlantic instrument. State information desired and mail. No postage is required.

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Model No. _____ Serial No. _____

We require the following service information: _____

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_____

Name _____ Title _____

Company _____ Dept. _____

Address _____

City _____ State _____ ZIP _____

Phone _____ Ext. _____

(please send additional Service Information Request cards)

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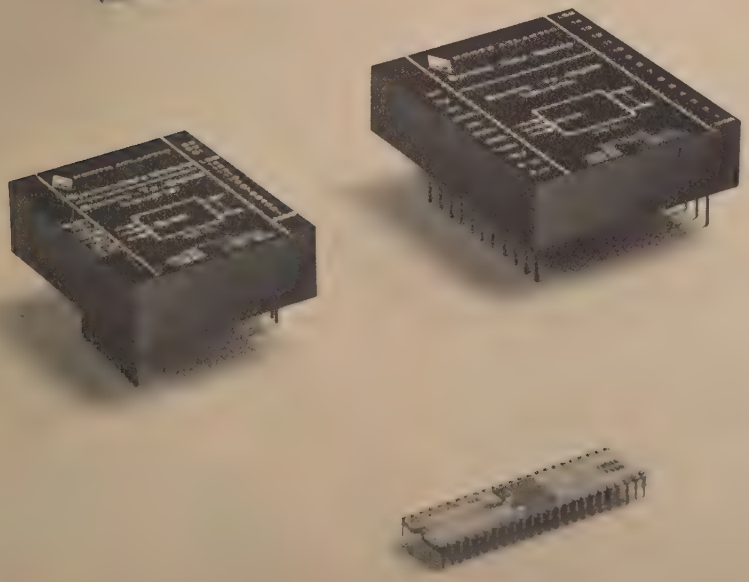

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DIGITAL PHASE ANGLE VOLTMETERS

This series of instruments provides the digital equivalent of the well-known Phase Angle Voltmeter, but with significant increases in both precision and speed of measurement. Voltage measurements include total, fundamental, in-phase, and quadrature. Phase measurements are from 0° to 359.9°, and a +45° reference offset control is provided. Full-scale voltage ranges (10mV to 1000mV) and phase angle (359.9°) are directly read on a 4-½ digit display. Voltage ranges may be pushbutton selected or auto-ranged. All models provide for both manual and remote programming or optional 488 IB (IEEE-STD-488-1975) interface bus. Digital outputs include reading, mode, range and polarity information as well as data status signals. Long-term use of this instrument series is assured since field-change of frequency plug-in modules requires only a routine recalibration procedure.

Model 225
Digital Phase Angle Voltmeter

Designed for multi-frequency applications, the Model 225 is available with 1, 2, 3, or 4 pre-specified plug-in frequency modules (30Hz to 54KHz). They feature pushbutton selection of Voltage range (or auto-range), measurement mode and frequency range. Voltage accuracy is 0.05% and phase accuracy is 0.2°. Local/remote pushbutton selection permits remote programming of all functions for ATE use. Broadband signal isolation features 10M input impedance. A standard null meter is included for applications such as synchro nulling (full-scale adjust is an option).

Model 225/Ratiometer
Digital Phase Angle Voltmeter

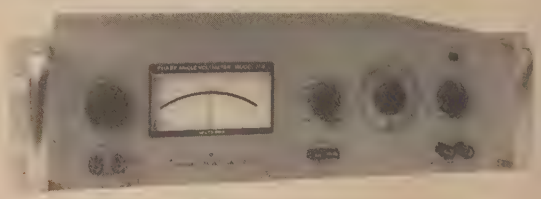
Incorporating all of the 225 features (and options), an added ratiometric mode provides direct reading ratio ranges from .0002 to 20.00. Signal input voltages (numerator) from 1mV to 500V, and reference voltages (denominator) from 3V to 126V are accommodated. No adjustments are required, only selection of the proper signal range. Accuracy is a function of reading, range, and reference level, and accuracies to .2% are achievable.

Model 220
Digital Phase Angle Voltmeter

Offered as a low-cost model for 400Hz production applications, the Model 220 is capable of the full range of voltage and phase measurements. It may be programmed remotely, and the digital outputs are provided. Optional signal isolation (10MΩ) is available.

PHASE ANGLE VOLTMETERS

These multifunctional instruments combine phase-sensitive modes with the functions of a conventional AC voltmeter operating over the range of 10Hz to 100KHz. They provide direct-reading voltage measurement of the total, fundamental, in-phase and quadrature components of an AC signal to 2% full-scale, as well as phase angle to 1°. They feature calibrated voltage ranges of 300*u*V (or 1mV) to 300V rms full-scale, built-in or plug-in harmonic-rejection filters, high quadrature overload capability, and operation with a wide range of reference voltages.



Model 213C
Phase Angle Voltmeters

This solid-state instrument, successor to the famous VM-202, provides phase-sensitive measurement at a single pre-specified frequency from 30Hz to 10KHz with +5% frequency bandwidth (without adjustment). Full-scale measurement from 300*u*V to 300V. The Model 213C has signal and reference isolation.

Model 321
Broadband Phase Angle Voltmeter

The Model 321 combines in one instrument, a phase sensitive null detector, a phase sensitive voltmeter and a phase meter, operating over the frequency range of 10Hz to 100KHz. It's broadband characteristics make it ideally suited for use in amplifier and network design, vibration analysis, telemetry system measurements, biomedical research, and similar applications requiring the measurement of complex signals and their vector components over a broad range of frequencies

The model 321 incorporates proprietary circuit techniques that eliminate the use of reactive phase shifters and filters while maintaining accuracy, stability, and greater than 40 db harmonic rejection. In addition to phase angle; total, fundamental, in-phase and quadrature voltages can be measured with respect to an arbitrary phase-shifted reference. The reference can vary from 150mV to 150V without the need for calibration or adjustment. The 321's versatility, accuracy, and ease of use make it ideally suited or both laboratory and production line use.

ANGLE POSITION INDICATORS

Model 800
Synchro Panel Meter

The new Model 800 Synchro Panel Meter reaches a new level in the price/performance balance of synchro angle indicators. Designed for system or test set applications, the Model 800 features 0.1° resolution and operates directly off the stator and rotor signals requiring no separate power. With its type II tracking loop, the Synchro Panel Meter has full digital output and is available with 0 to 359.9, ±179.9 and 0 to 9999 ranges. It has ±2° offset adjust to allow for final system zeroing and pin programming for all standard synchro or resolver signals for maximum flexibility.

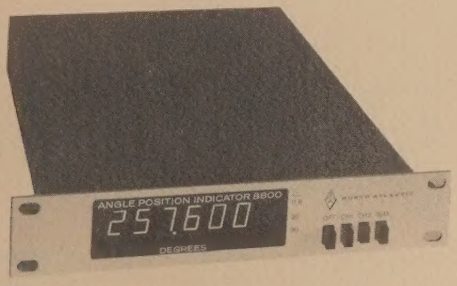
ANGLE POSITION INDICATORS

Model 8300
Angle Position Indicator

The Model 8300 offers a combination of LSI-enhanced reliability, low cost, and features never before available in any angle position indicator. Through use of direct hard-wire programming in the mating rear connector mode and line-line are selected (resolver or snychro - 11.8V, 26V or 90V) for each of two front-panel pushbutton selected channels. Each of the two data channels may have independent references from 47Hz to 440Hz. Thus, one channel may read 11.8V, 400Hz resolver data and the other 90V, 60Hz synchro data. Absolute accuracy is .05° for data rates up to 5rps (1800°/second). Resolution is .01°. Digital outputs are 5-decade BCD data lines plus converter control and data status lines. Options include degrees/minutes display, +180° display, and higher accuracy (+0.03°).

Model 8310
Angle Position Indicator

The model 8310 is a bench top model of the 8300 featuring full front panel controls and input terminations, data freeze button, tilt stand and mounting ears for rack mounting (if desired).



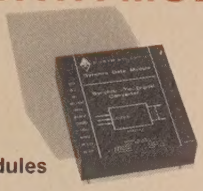
Model 8800
Angle Position Indicator

The Model 8800 is a growth version of the basic model 8300 described above. Featuring resolution up to 0.001 (optional) and accuracy up to 0.003° (optional), the LSI based Model 8800 truly represents a major advance in synchro-to-digital converter technology. A full type II tracking servo, the 8800 can track synchros at speeds up to 1000°/sec. Phase sensitive detection inherently rejects unwanted harmonics and noise contained in the incoming signal. Built-in auto-phase correction further reduces the possibility of errors caused by quadrature and harmonics when reference and signal are out of phase. The 8800 accepts any standard line-to-line level *without* preselecting or preprogramming the input signal. This unique feature is due to an auto-ranging circuit that displays the applied input signal voltage level on the front panel. Two pushbutton front-panel selectable input channels are provided. BCD outputs, data freeze and converter busy signals make the unit ideal for ATE application. The display is a bright, easy-to-read, 0.55" gas discharge planar display coupled with our exclusive LAZY-EIGHT ambiguity indicator (discerns between real 8's and 8's due to jitter).

Model 8810
Angle Position Indicator

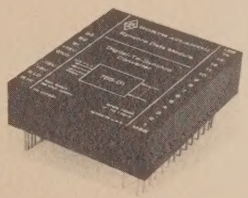
The Model 8810 is a bench top version of the model 8800 (above) featuring full front panel controls and input terminations, tilt stand and ears for rack mounting (if desired). Additionally, the Model 8810 is available with the 488 IB (IEEE STD 488-1975) interface bus for ATE applications.

SYNCHRO DATA MODULES



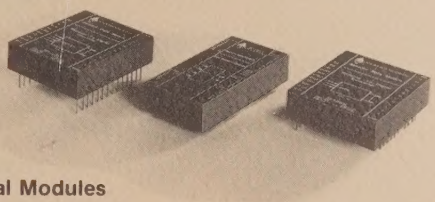
Series LSI/85
Snychro-To-Digital Modules

The 10-, 12- and 14-bit LSI/85 feature an industry-first use of LSI for improved operating reliability. Pin-compatible with DDC modules, synchro and resolver models feature 4-minute accuracy at data speeds to 3660°/second for 400Hz units and 500°/seconds for 60Hz units, line-line voltages of 11.8V, 26V, or 90V, 0° to 70°C operation (optional to 105°C). Built-in protection against improper power polarity, power transients and signal transients. Size: 3.125" x 2.625" x .82".



Series 785
Digital-To-Synchro Modules

The 14-bit Series 785 features 4-minute accuracy under full 1.25VA output load with a maximum 1% line-line variation for resolver and synchro models. Rated at 0° to 70°C (optional to 105°C), modules are fully protected against damage from overload or short-circuit. Size: (same as LSI/85): 3.125" x 2.625" x .82".



Series LSI/36
2 Speed
Synchro to Digital Modules

The North Atlantic LSI/36 two speed modular S/D converters are based on the use of LSI and 100 hr. burn-in to achieve higher inherent reliability than competitive units. Consisting of two independant type II tracking converters and a digital combiner, the LSI/36 offers single speed and multispeed comonality, high performance, and immunity from analog cross over instability common in some two speed S/D's. Full 19 bit resolution reduces the quantization error to less than 1.3 seconds.

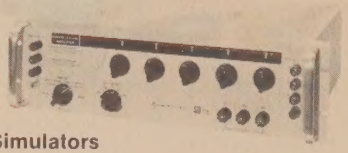
High performance specifications include tracking to 10 rps on fine speed shaft (400Hz) ±15 seconds maximum worst case error including combiner error, temperature and velocity error, power supply variations and quantization error. Two temperature ranges are available: 0°C to +70°C and -55°C to +100°C. Converter modules are full transient protected on the synchro or resolver lines while the ±15V are protected against power transients or voltage reversal. Std. units are for 1x, 36x speed ratios but other ratios are available. The encapsulated nature of these modules makes them ideal for severe industrial or military applications such as fire control, navigation, ATE or antenna positioning systems.

Series MSC/36
2 Speed
Digital Combiner

The MSC/36 two speed combiner accepts two binary angle words representing main shaft (x1) and vernier shaft (x36) and delivers a combined unambiguous main shaft angle output with a resolution of 19 bits. Input and output is TTL compatible and all operations are performed in parallel. No timing or control signals are required. Packaged in a 2 x 4 x .8 module the MSC/36 is available in 0°C to 70°C or-55°C to +100°C. Standard unit is for 1x, 36x speed ratio but alternate ratios are also available.

Many other versions of all series are available, eg, 2 speed, synchro/ACP, ACP/synchro, digital CT, digital CDX, high power D/S for TR applications, frequencies other than 60-400Hz, etc.

RESOLVER/SYNCHRO SIMULATORS & BRIDGES

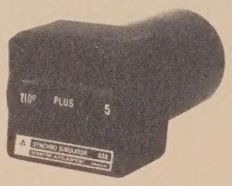


Series 530
Resolver/Synchro Simulators

These simulators provide the ideal outputs for driving resolvers and synchros at 11.8, 26, 90 and 115V line-line voltages. These line-line voltages are all available with either 26V or 115V 400Hz excitation, and feature isolated input and output. Accuracy is 2 arc-seconds. Resolution is .0001°, with standard units 3½" full rack panel.

Model 530/20
Broadband Resolver/Synchro Simulator

The Model 530/20 features 10 arc-second accuracy at 60Hz, 400Hz, and 800Hz, and 20 arc-second accuracy at 10KHz. It is useable over the entire frequency band from 50Hz to 10KHz. This broadband frequency characteristic makes it an ideal instrument for test facilities desiring the maximum capability in each instrument.



Model 532
Low-Cost Synchro Simulator

Model 531
Low-Cost Resolver Simulator

Model 532 is a miniature synchro simulator offering precision performance in a small panel-mounted unit suitable for production test, ground support and similar systems. Direct simulation of 11.8V 400Hz line-line synchro transmitters (CX) is provided, with dial reading in 30° segments plus 5° increments selectable by sealed thumbwheel switches and accurate to 30 arc-seconds. Also available are a Model 532 with 90V line-line ouput, and a Model 531 with 26V resolver output. All models feature the same construction, display, and accuracy.

Model 540/10 & 540/11
Resolver/Synchro Bridges

These bridges permit direct measurement of resolver and synchro transmitters. They feature a constant null gradient output voltage, isolated input and output, and input impedance over 500K. The Model 540/10 features 2 arc-second accuracy at 400Hz, and the Model 540/11 2 arc-seconds over the band of 400Hz to 1000Hz. Standard resolution is .0001°. All units are provided in a 3½" full-rack panel.

Model 540/20
Broadband Resolver/Synchro Bridge

The Model 540/20 features 10 arc-second accuracy over most of the frequency band from 55Hz to 10KHz. Also featured is a constant null gradient voltage which permits deviation measurements by using a Phase Angle Voltmeter as the null detector.

SALES OFFICES

North Atlantic Sales Engineering Representatives are located in principal cities throughout the world. These representatives are available for consultation, can provide engineering data on any of the North Atlantic's products, or prepare technical and cost proposals for special requirements on computer interface equipment, phase sensitive instrumentation, resolver/synchro instrumentation and automatic test equipment. To locate the Sales Engineering Representative serving your area, please consult the current editions of EEM (Electronic Engineers Master), EBG (Electronic Buyers' Guide), Gold Book (Electronic Design), or contact our Sales Department.

SERVICE CENTERS

Factory service is available at authorized Service Centers in:

LOS ANGELES, CA
MINNEAPOLIS, MN
HAUPPAUGE, NY
LONDON, ENGLAND
MUNICH, GERMANY
PARIS, FRANCE
TEL AVIV, ISRAEL
TOKYO, JAPAN

DIGITAL TO RESOLVER/ SYNCHRO CONVERTERS

Series 538
Digital-To-Resolver/Synchro Converters

The Series 538 D/R-S Converters offer 9- to 17-bit single-speed resolution with digital input as binary angle. The input register is strobed and digital data is then held until the next strobe. The internal logic selects the appropriate trigonometric transformer taps, thus simulating actual 4-wire resolver or 3-wire synchro data at the selected line-line voltage. Built-in protection circuits are provided for power-line voltage and frequency transients, overload and short circuit. The Models 538/10 (full-rack) and 538/20 (half-rack) converters provide 14- to 17- bit resolution with better than 1-minute accuracy. Options include special input logic and multi-speed outputs. Converters are of all solid-state construction and feature output transformer isolation and short-circuit protection. All models accept 400Hz as the signal data frequency.

TECHNICAL SEMINARS

North Atlantic conducts a variety of technical seminars to acquaint system and test engineers with the technology and application of our instrumentation. These seminars are useful in suggesting solutions to particular instrumentation and interface problems. Conducted within your facility, these half- and one-day seminars follow prepared outlines and utilize workbooks. They are available without charge to interested companies. Your local North Atlantic Sales Engineering Representative will be pleased to describe available subects and to schedule one or more of these seminars to suit the convenience of your engineering staff.

TECHNICAL BULLETINS

North Atlantic publishes a series of technical bulletins dealing with theoretical design and application aspects of instrumentation. Copies are available without charge from our Sales Department or from any North Atlantic Sales Engineering Representative.

NO. 101 AC SIGNAL MEASUREMENT FOR SUPPORT EQUIPMENT
NO. 102 RATIOMETRIC MEASUREMENTS: TECHNIQUES AND ACCURACIES
NO. 104 PHASE SENSITIVE CONVERSION APPLIED TO AUTOMATIC AC MEASUREMENT
NO. 107 MODERN METHODS OF EVALUATING SYNCHRO AND RESOLVER COMPONENTS
NO. 108 MEASURING AC RATIO AUTOMATICALLY
NO. 109 AC MEASUREMENT BY PHASE-SENSITIVE CONVERSION
NO. 110 HOW TO MEASURE PHASE-SENSITIVE NULL IN RATIO BRIDGES
NO. 111 EVOLUTION OF THE PHASE ANGLE VOLTMETER
NO. 112 CONVERTING MOTION TO DIGITAL DATA
NO. 113 SERVO-STYLE CIRCUIT SPEEDS SYNCHRO-TO-DIGITAL CONVERSION
NO. 114 APPLYING SERVO SYSTEMS TO GET HIGH-RESOLUTION READOUTS
NO. 115 SYNCHRO-TO-DIGITAL CONVERTERS: PICK THE ONE THAT DOES THE JOB
NO. 116 ACQUISITION OF SHAFT-ANGLE DATA
NO. 117 SYNCHRO RESOLVER-TO-DIGITAL CONVERSION FOR COMPUTER INTERFACE
NO. 120 PHASE ANGLE VOLTMETERS.

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